

IN THE DRAWINGS

The attached sheets of drawings include changes to Figs. 3, 10, and 12. These sheets, which include Figs. 3, 10, and 12, replace the original sheets including Figs. 3, 10, and 12.

Attachment: Replacement Sheets

REMARKS

Favorable reconsideration of this application is respectfully requested.

Replacement Figures 3, 10, and 12 are submitted herein. Replacement Figure 3 now deletes the extraneous reference number --3--. Replacement Figure 10 now properly provides the indication for reference numbers --203a-- and --203b--. Replacement Figure 12 now properly indicates to what reference number --407-- is pointing.

The submission of replacement Figures 3, 10, and 12 is believed to address the outstanding objection to the drawings noted in paragraph 2 of the Office Action.

The specification is amended to clarify certain language therein. A replacement Abstract believed to be in more proper format under United States practice is also submitted, which is believed to address the objection in paragraph 3 of the Office Action.

Claims 6, 18, 25, 26, 33, and 34 are herein amended to address the objections noted in paragraph 4 of the Office Action.

Claims 1-3 and 5-34 are pending in this application. Claim 4 is herein canceled by the present response without prejudice, the subject matter of canceled dependent claim 4 being added to each of the independent claims. Claims 1, 4, 12-14, 17, 21, 24, 33, and 34 were rejected under 35 U.S.C. §112, second paragraph. Claims 1, 2, 5-12, and 32-34 were rejected under 35 U.S.C. §102(b) as anticipated by U.S. patent 5,764,765 to Phoenix et al. (herein "Phoenix"). Claim 3 was rejected under 35 U.S.C. §103(a) as unpatentable over Phoenix as applied to claim 1, and further in view of U.S. patent 5,757,912 to Blow. Claims 4 and 13-27 were rejected under 35 U.S.C. §103(a) as unpatentable over Phoenix as applied to claims 1 and 12, and further in view of U.S. patent 5,307,410 to Bennett. Claims 28-31 were rejected under 35 U.S.C. §103(a) as unpatentable over Phoenix. Those rejections are traversed by the present response as discussed next.

Addressing first the rejection of 1, 4, 12-14, 17, 21, 24, 33, and 34 under 35 U.S.C. §112, second paragraph, that rejection is traversed by the present response.

Claims 1, 33, and 34 were rejected as the term “having a probability” was not defined by the claims. That language has now been deleted in claims 1, 33, and 34, and the claims now recite “when the average number of photons per pulse is less than 1”. That subject matter is clear from the original specification, see for example the paragraph bridging pages 1 and 2 and page 19, second paragraph, as non-limiting examples.

Claim 12 is amended by the present response to clarify the language noted therein as unclear.

Claim 4 is herein canceled without prejudice and the subject matter of claim 4 now included in the independent claims is written to no longer refer to the noted “signal”.

Claims 13, 14, 17, 21, and 24 are all herein amended to no longer recite the term “allow”, and to clarify the terminology therein.

The presently submitted amendments to the above-noted claims are believed to address the outstanding rejections under 35 U.S.C. §112, second paragraph.

Addressing now the above-noted prior art rejections, those rejections are traversed by the present response.

Each of the independent claims is amended by the present response to clarify features recited therein. Independent claim 1 now specifically recites:

wherein the separation between pulses in said group of pulses is less than the time when a detector may register an after pulse signal or a false positive reading, the detector is in an on state for at least the duration of two photon pulses during said group time period, and the system is configured to ignore a second or subsequent pulse received by the detector in a group time period after a first pulse has been detected for the group of pulses.

Independent claims 33 and 34 are herein amended to recite similar features. The claimed features are believed to clearly distinguish over the applied art.

The applicants of the claimed inventions recognized that in conventional systems a problem with an “after pulse” when using certain types of single photon detectors has arisen. An after pulse reading can cause a false positive after a true reading has been registered. To avoid such after pulse readings, it has been known to reduce the rate at which single photons are sent through a quantum communication system to a detector.¹

The inventors of the present invention realized that as pulses are sent so that each pulse contains at most one photon, many pulses will contain zero pulses. Therefore, the claimed inventions improve a bit rate by grouping pulses together, and the spacing between the pulses is less than a time necessary to avoid after pulse effects.

With such a system and method, in practice it would be rare for any group of pulses to contain more than one pulse with a photon since many of the pulses will have zero photons. However, if more than one photon pulse is detected in a group of pulses, then any second or subsequent detected photon pulse is ignored. Such a system provides the advantage of increasing a bit rate by more efficient system use.

Each outstanding rejection cites Phoenix as the primary reference, and with respect to claims 1, 33, and 34 as previously written the outstanding rejection specifically cited Phoenix at column 3, lines 10-12, column 4, lines 1-6, and column 4, lines 57-65. The outstanding rejection specifically relied on Phoenix at column 4, lines 57-65 to disclose a detector is in an ON state for at least the duration of two photon pulses during the group time period.

With respect to that specific grounds for rejection, applicants submit in Phoenix at cited column 4, lines 57-65 there is no disclosure or suggestion that a detector is kept ON during a whole time when signal pulses are likely to arrive.

Moreover, as noted above, each of independent claims 1, 33, and 34 is herein amended to clarify features of detection of the pulses, to specifically clarify the separation

¹ Specification for example at pages 2-3.

between pulses in the group of pulses is less than the time when the detector may register an after pulse signal or false positive reading, and further to ignore a second or subsequent pulse received by the detector in a group time period after the first pulse has been detected for the group of pulses. Applicants submit Phoenix does not disclose or suggest any such features.

With respect to features previously recited in dependent claim 4, which are now clarified in independent claims 1, 33, and 34, the outstanding rejection cited Bennett at column 7, lines 14-36.

In reply to that grounds for rejection applicants note that disclosure in Bennett refers to throwing away of certain pulses. Applicants submit Bennett is not, however, directed to the features recited in independent claims 1, 33, and 34 as currently written, which recite “ignoring a second or subsequent pulse in a group ...after a first pulse has been detected”. Such an operation is believed to clearly differ from throwing away the noted pulses in Bennett.

For example, with reference to Figure 4 in the present specification, one operation possible by the claimed inventions is that pulses in the group of pulses that arrive at the detector are the three central pulses. If all three central pulses arrive, then only the result from the first pulse will be kept as it is not possible to determine if the results from the other two pulses are due to after pulse effects. Bennett is not directed to any such features.

Moreover, no teachings in Blow were cited with respect to the above-noted features, and no teachings in Blow are believed to cure the above-noted deficiencies of Phoenix and further in view of Bennett.

Applicants also note a further grounds for rejection cites Phoenix in view of Official Notice that “it would have been obvious to one of ordinary skill in the art to vary the number of pulses in each group, the number of photons per pulse and use a range of timing intervals

to improve the efficiency and the reduce the occurrence of pulse collisions in the operation of the invention".²

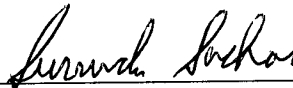
Applicants traverse that basis for Official Notice and require that prior art be cited for that proposition. Also, applicants respectfully submit there does not appear to be any suggestion to one of ordinary skill in the art to modify Phoenix in view of even the position for Official Notice. Applicants also note claims 28-31 recite more specific features than even for what the Official Notice was taken, and thus that further grounds for Official Notice is traversed.

In view of the present response, applicants respectfully submit the claims as currently written positively recite features neither taught nor suggested by the applied art, and thus are allowable over the applied art.

As no other issues are pending in this application, it is respectfully submitted that the present application is now in condition for allowance, and it is hereby respectfully requested that this case be passed to issue.

Respectfully submitted,

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² Office Action of January 17, 2008, page 16, last paragraph.